

# PATENT ABSTRACTS OF JAPAN

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## (54) CABLE WITH THIN-FILM MAGNETIC SHIELD

### (57)Abstract:

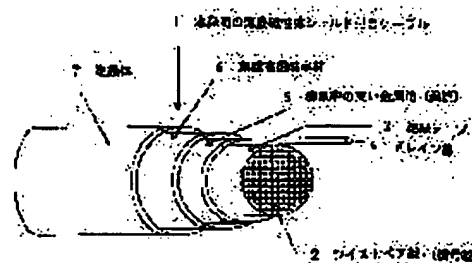
**PROBLEM TO BE SOLVED:** To provide a cable fitted with a shield to be used as interface cables for connecting office automation apparatuses such as personal computers, games, and telecommunication

apparatuses, and as cables used for intra-apparatus wiring, and the like.

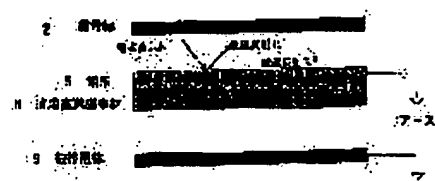
**SOLUTION:** In the first embodiment, a cable has a structure fitted with a thin-film magnetic substance shield, made by winding an insulation tape 3 around a plurality of signal wires 2, winding thereon a tape of high conductivity metallic foil 5 laminated with one or plural sheets of thin-film

high magnetic permeability material 6 or laminated thin-film high magnetic permeability material 6, and further winding thereon an insulating material 7, and this cable has a high shield effect over a wide range, is easy to handle, and can keep a fine view without needing to increase the diameter of the cable so much, by shielding radiation noise, not sufficiently absorbed by copper foil, with the thin-film magnetic

substance, by providing the shield of the high conductivity metallic foil (copper foil, etc.) laminated from outside with the thin-film high magnetic permeability material. In the second embodiment, slits are provided in the tape described in the first embodiment, whereby an antenna effect of the entire cable is eliminated and an effect of eddy current of the high-magnetic permeability material is suppressed, and thereby influence of radiation noise can be removed over a wide range.



(a)



(b)

## LEGAL STATUS

## \* NOTICES \*

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the cable with a shield used for the interface cable to which between OA equipment, such as a personal computer, a game machine, and communication equipment is connected, the cable for the wiring in a device, etc.

[0002]

[Problem(s) to be Solved by the Invention] The environment where current and we are placed is enclosed by the electric wave of various frequency bands, and has received regulation of EMC severely in the device. Also in a cable, it is the same, and when cable length becomes equal to  $n\lambda/4$ , it works as an efficient antenna and the antenna effect which performs radiation or reception of an electromagnetic wave happens. Therefore, various cures have been made until now. As a method of shielding a cable, there are \*\* braided wire, \*\* wire mesh line tape, \*\* metallic foil tape, \*\* shrink tube, \*\* lamination tape, a \*\* ferrite core, etc. \*\* Each method to -\*\* was twisted around the outside of a signal line, it is carrying out ground installation and the principle which drops to a gland the RF noise which leaked and came out of the signal line is applied. Moreover, about the ferrite core of \*\*, while the magnetic field by the current frequency which flows to a signal line only carries out using the principle which it converges with the permeability of a ferrite, in high region frequency, by the defect and RF from a crevice that leakage cannot perform a perfect shield, it becomes impossible to disregard the inductance of a shield portion, and a noise will ride [ tape / the braided wire of \*\*, and / of \*\* / wire mesh line ] on a shield. That is, in the RF, since GND cannot grow into Ideal GND, the problem has arisen. Moreover, about the metallic foil tape of \*\*, the shrink tube of \*\*, and the lamination tape of \*\*, shield material is thick and the defect that it can seldom wish was [ in high region frequency, the eddy current became large and ] effective. Although there was also a material corresponding to a high region considerably about the ferrite core of the last \*\*, since a damping effect was proportional to the volume of a core, the configuration became large, and it was hard to deal with it, and it had troubles, such as spoiling a fine sight. if the demand technical problem of the present shielded cable is summarized from the above thing -- a thing with the easy thing \*\* handling with the inductive high impedance of :shield material corresponding to thing 2. absorption with the high conductivity of large :shield material corresponding to thing 1. electric shielding of \*\* shielding effect.

\*\* It is not bulky.

\*\* Narrow-diameter-izing of a cable.

\*\* is mentioned.

[0003]

[The means for solving invention] It is the cable structure with a thin film magnetic-substance shield which twisted what laminated one sheet thru/or two or more sheets in the metallic foil with high conductivity, and used as the tape the high permeability material of a thin film, or the high permeability material of a thin film which carried out the laminating as the 1st of this invention. As the 2nd of this invention, it is the cable with a thin film magnetic-substance shield which prepared the slit in the 1st tape.

[0004]

[Function] It is the cable structure with a thin film magnetic-substance shield which twisted around the cable what laminated and tape-ized thin film high permeability material to the metallic foil with high conductivity as the 1st of this invention. By covering in metallic foils with high conductivity (copper foil etc.), and laminating the high permeability material of a thin film on the outside By carrying out electric shielding absorption and attenuating the radiation noise which cannot be absorbed in copper foil with the thin film magnetic substance, a rear-spring-supporter shielding effect is obtained for a wide area, and it is easy to treat, and a fine sight can also be maintained, without making the diameter of a

cable so thick. The antenna effect in the whole cable is lost, and the effect of a rear-spring-supporter radiation noise can be prevented from coming out of the effect of the eddy current of high permeability material to a presser foot and a broadband small by preparing a slit in the 1st tape as the 2nd of this invention.

[0005]

[Embodiment of the Invention] Hereafter, the example of the cable 1 with a thin film magnetic-substance shield of this invention is explained to details with reference to an accompanying drawing. Drawing 1 (b) is the typical example of this invention, and the perspective diagram of the cable 1 with a thin film magnetic-substance shield and drawing 1 (b) are shield concept explanatory drawings of this invention. It is the cable 1 with a thin film magnetic-substance shield characterized by having given the insulating tape 3 to the surroundings of the signal line 2 which consists of two or more as the 1st of this invention, having twisted around the metallic foil 5 with high conductivity what laminated one sheet thru/or two or more sheets, and used as the tape the high permeability material 6 of a thin film, or the high permeability material 6 of a thin film which carried out the laminating, and giving an insulating material 7 on it further on it so that clearly from drawing. Effect can be prevented from appearing in transmission frequency by preparing a slit in the 1st tape as the 2nd of this invention by losing the antenna effect in the whole cable, and pressing down small the effect of the eddy current of high permeability material. In order to prepare a slit in a tape, a slit may be prepared in the same direction or the direction of slant to the length direction of a cable, or the shape of a cross like + may be formed. As thin film high permeability material, the permalloy was used as a typical thing. Moreover, although it is variously about the manufacture method of the high permeability material of a thin film, if the field of that stress, such as bending of a cable, starts and a price is taken into consideration, it can be good and one sheet cannot be found, and what carried out rolling processing will laminate two or more sheets, and will make it a tape. Typical PVC resin was used as an insulating material 7. This invention is the so-called concept of a duplex shield, and aims at a secondary shielding effect to the frequency noise which leaked with a primary side shield. Here, conceptual explanatory drawing about the conventional common shield is shown in drawing 2, and the principle of a shield is explained briefly. The principle of a shield uses that current flows in it using the electrical conducting material of low resistance, and prevents the interaction of line of magnetic force. Moreover, it is grounding this and is electrostatic. As for a shielding effect, a degree type is realized for an example in the case of copper foil.

[0006]

[Equation 1]

$$S=A+R+B \dots\dots\dots (1)$$

[0007]

S: Shielding effect (dB)

A: Absorption loss (dB)

R: Reflection loss (dB)

B: Multiple echo inside a shielding material ... Almost can be disregarded.

[0008]

[Equation 2]

$$A=3.3t(fG\mu)^{1/2} \dots\dots\dots (2)$$

[0009]

G: specific conductivity  $\mu$ : to copper -- permeability f: frequency t: in free space -- about the thickness of a shielding material, therefore absorption loss, a better shielding effect is expectable, so that conductivity and permeability are large.

[0010]

[Equation 3]

$$R=3.69 \times 10^{-7} (\mu f / G)^{1/2} \dots\dots\dots (3)$$

[0011] Therefore, about reflection loss, a better shielding effect is expectable, so that conductivity is small and permeability is large. From the above thing, as shown in the drawing 1 (\*\*), this invention is covered in metallic foils with high conductivity (copper foil etc.), it is laminating the high permeability material of a thin film on the outside, and the radiation noise which cannot be absorbed in copper foil is covered with the thin film magnetic substance. Moreover, when a RF noise cannot be absorbed further, it corresponds by the laminating of a thin film. Since it was the above structures, as a result of comparing with the cable 1 with a thin film magnetic-substance shield of this invention by the conventional case, the improvement of EMI was found compared with the conventional thing.

[0012] Although the typical interface and the cable cable with a shield have explained in the activity example of the cable 1 with a thin film magnetic-substance shield of this invention, it does not restrict to this, and broad application is possible. Thus, it cannot be overemphasized that it is a thing including various kinds of deformation by within the limits of a twisted pair wire 2, an insulating material 7, or drain wire 4 grade this invention.

[0013]

[Effect of the Invention] The shielding effect to a RF is obtained more than at the shielding effect from which the cable 1 with a thin film magnetic-substance shield of this invention is obtained with the configuration of 1. former so that clearly from the above explanation.

2. By thin-film-izing, the diameter of a cable does not need to become thick, and processing with the conventional connector with a shield is easy.

3. A broadband response is attained with the combination of a metallic foil and a thin film magnetic material. Since the outstanding effect to say can be done so, a so-called size has the industrial value.

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[Translation done.]